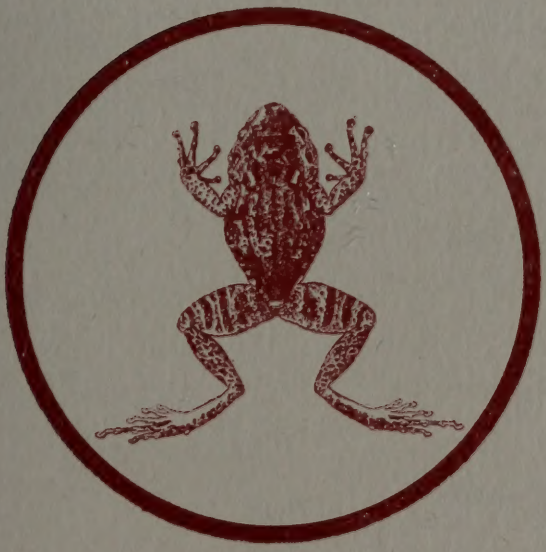
ANNUAL REPORT
1967-1968

MUSEUM OF COMPARATIVE ZOOLOGY

The Agassiz Museum



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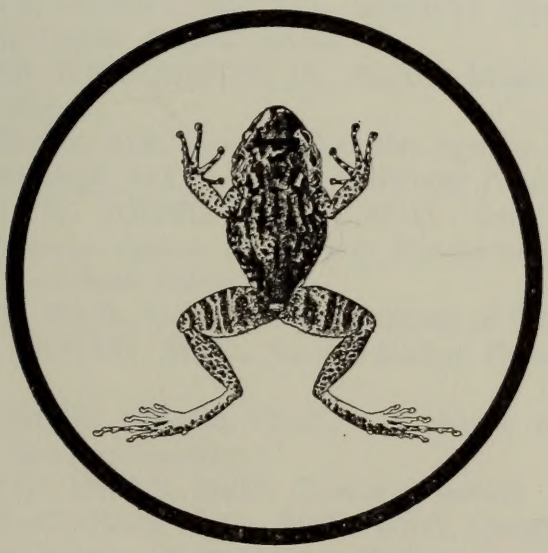

Eleutherodactylus leoncei Shreve

HARVARD UNIVERSITY
CAMBRIDGE, MASSACHUSETTS
1969

MUSEUM OF COMPARATIVE ZOOLOGY

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MUSEUM OF COMPARATIVE ZOOLOGY

Report of the Director

1967-1968

No other branch of science ranges between such extremes as biology. Biologists who attempt to unravel the secrets of the structure of organic molecules or cell physiologists who study the physical chemistry of intracellular membranes seem to be dealing with an entirely different world than that of the students of evolution or behavior. The reason these worlds are so different is that every organism in itself seems to comprise two worlds.

On the one hand is the body, with its chemistry and physiology, constantly seeking compromises between the dictates of its heritage and the demands of its environment. From the moment that the fertilized egg cell begins to develop, until death, an almost unlimited number of functional tasks must be performed, from the molecular level up to the level of the behavior of the organism as a whole. It is the task of functional biology to study this aspect of organisms. On the other hand is the individual's heritage, contained in the genetic program of the DNA of every nucleus. This genetic program is the result of evolution; it is the result of natural selection through countless past generations. The evolutionary biologist, the research worker in the MCZ, studies the forces that lead to evolutionary changes. He deals with all the phenomena related to the evolutionary success of various organisms as determined by their genetic endowment.

This area of biological research requires a working method

quite different from that of functional biology. Comparison is the basic method of evolutionary biology, although experiment is used whenever feasible. Comparative zoology traditionally relied on a comparison of specimens, either taxonomically or anatomically. However, comparison of living organisms, their behavior and ecology, is as much a part of comparative zoology as is the study of preserved material. This is why field research has become such an indispensable part of the task of a museum of comparative zoology. The ever greater role played by the study of the living organism has led in recent years to a redefinition of systematics as *the study of the diversity of organisms.* The task of the systematic zoologist has thus expanded, presenting him with new challenges and resulting in a new role for systematics within the framework of biology, which I have described in a recent essay (Science, Vol. 159, p. 595).

The differences between the two kinds of biology are reflected not only in research but also in instruction. There is great need for instruction in evolutionary, behavioral, and systematic biology, and such instruction must be handled by qualified experts in these fields. This is why the scientific staff of the Museum is making an increasingly large contribution to both undergraduate and graduate instruction, as set forth in recent annual reports.

It must not be forgotten that the staff of the Museum has many obligations in addition to research and instruction. The MCZ houses world-famous scientific collections, which are studied by specialists far and wide. Every day curators receive inquiries about specimens in the collections under their care; frequently an inquiry culminates either in a request for a loan or in a personal visit by a nonresident investigator. During the past year, for example, the Museum made 350 loans in the United States and 106 to foreign institutions, loans totalling over 7,000 specimens; 875 loans are currently outstanding. Our collections are used even more by visiting scientists, who work at the Museum for hours,

days, or whole months. In the past year, 472 US and 110 foreign scientists worked in the MCZ, as did 121 graduate students from other universities (in addition to innumerable Harvard students).

We are often asked about the size of our collections. This is a question we cannot answer in detail, because our staff has more important things to do than to count specimens. We can, however, make fairly accurate estimates; these indicate that the collections contain about 10 million specimens of mollusks, 5 million mounted and labeled insects, more than 1 million arachnids, 315,000 birds, 200,000 echinoderms, 102,000 lots of reptiles, 64,000 lots of amphibians, and 50,000 lots of fishes, to mention only the biggest of them. There are about 27,000 lots of fossil invertebrates, 15,000 fossil mammals, and 6,000 other fossil vertebrates. As far as types are concerned, we have close to 50,000 holotypes or other primary types (lectotypes).

The responsibilities of our staff are commensurate with the importance of these collections. Inquiries about specimens must be answered and cannot be delegated, in most instances, to a clerical employee. When there is no specialist for a given group, as is true at present for coelenterates, crustaceans, lepidopterans, dipterans, fossil fishes, and most fossil invertebrates, to mention especially important material, the burden on the curator in charge of these collections is particularly heavy. This is why our research curators do not carry as heavy a teaching load as do those in the Biology Department who do not have these obligations.

The need for the Museum's proposed new wing becomes more acute each year. It is a pleasure to report that we have received a grant toward it of $625,000 from the National Science Foundation; other moneys are also in hand, but a substantial portion of the total cost (approximately $2,800,000) will have to be raised through the Program for Science in Harvard College. It will be possible to appoint several Alexander Agassiz Professors as soon as this facility becomes

available. The Museum is a leader in systematic and evolutionary biology; the new wing must be built if we are to maintain this leadership.

I record with sadness the death of Henry Bryant Bigelow, Professor of Zoology, Emeritus, on December 11, in his eighty-ninth year. "Uncle Henry" was associated with the Museum for 61 years, and until his death he took an active interest in all of its affairs. We have lost a very dear friend. Before his death, Professor Bigelow established the Bigelow Fund to support teaching and research in ichthyology and other aspects of marine sciences. Gifts from his wife, Elizabeth Shattuck Bigelow of Concord, Massachusetts, and friends have now enabled the Museum to endow a new chair, the Henry Bryant Bigelow Professorship in Ichthyology. Establishment of the Bigelow Chair in the Museum seems particularly appropriate, since fishes were Louis Agassiz's specialty and their study has been a major concern of the MCZ since its founding. Through numerous expeditions for more than a century, the Museum has assembled one of the finest university collections of marine and freshwater fishes in the world. With the steady increase not only in the size of this collection but also in the number of students, the present facilities have become quite inadequate. Two entire floors in the new wing will therefore be devoted to oceanography and the science of fishes. These new facilities, together with the new Bigelow Chair, will raise ichthyology at the Museum to a new level of activity and excellence.

I am pleased to report that there were 65 members in the group known as the Friends of the MCZ at the end of this, its first year as an organization. The Friends, people interested in supporting and participating in the varied activities of the Museum, are listed at the end of this report (Appendix II). There were three meetings this past year: an inaugural dinner at the Museum in the fall; a lecture in January, in which I tried to demonstrate how intriguingly unlikely was the evolution of Man; and, finally, a visit in May to the

outdoor extension of the MCZ, the new Concord Field Station in the Estabrook Woods. (Research and teaching at the station are well underway, and the program is steadily expanding; further endowment will be needed, however, as it continues to develop.) I hope that the Friends of the MCZ will increase in numbers; that others will wish to learn about the activities of the Museum and will find participation in these activities enriching.

ERNST MAYR, *Director*

STAFF

New staff appointments during this reporting year include Stephen J. Gould (A.B. Antioch College, Ph.D. Columbia University), Assistant Curator in Invertebrate Paleontology; Ruth E. Hill (B.S. University of Massachusetts, B.S. in L.S. Simmons College), Librarian; and Michael J. D. White of the University of Melbourne, Australia, Alexander Agassiz Visiting Professor of Zoology. There were five newly appointed Associates: Melbourne R. Carriker (Malacology); Richard H. Chesher (Marine Zoology); Robert H. Hessler and Howard L. Sanders (Invertebrate Zoology); Paulo E. Vanzolini (Herpetology).

After more than 30 years of dedicated service, Nelda E. Wright retired in June as editor of the MCZ *Bulletin* and *Breviora*. The Museum publications have long been of importance to the serious scientific community at large; their excellence has been in no small part due to Miss Wright's intelligent and diligent editorial work. We are pleased that she will continue to work at the Museum in her other capacity, that of Dr. Romer's research assistant, as she has done for many years. Miss Wright's assistant for the last several years, Mrs. Elizabeth Pfohl, has taken on the duties of editor.

Of particular interest among the awards and honors received by staff members this year was the William J. Walker Prize, awarded by the Boston Museum of Science to Dr.

Evans "in recognition of meritorious published scientific investigation and discovery" in the general area of natural history. The degree of Doctor of Science, *honoris causa,* was received by Dr. Simpson from Kenyon College and from the University of Colorado; Dr. Mayr was made an Honorary Member of the Sociedad Colombiana de Naturalistas; and Dr. Carpenter was appointed Griswold Lecturer at Cornell University in April.

Service on various committees of scientific organizations all over the world and participation in their activities have always been an important aspect of the pursuits of our staff; this year has been no exception. Dr. Mayr served on the Committee on History and Science at Harvard and on the Peabody Museum Committee of Yale; he was appointed Research Associate of the American Museum of Natural History for the years 1968 to 1971. He also continued as Chairman of the Panel on the Diversity of Life of the National Academy of Sciences, Committee on Science and Public Policy, and as Honorary Research Associate of the Smithsonian Tropical Research Institute. In addition to her position as an Honorary Research Associate of the Institute of Marine Science of the University of Puerto Rico, Dr. Turner was appointed as a consultant for the Systematics-Ecology Program of the Marine Biological Laboratory at Woods Hole. Dr. Clench's appointment as Research Associate of the American Museum of Natural History was renewed for another three years. Both Dr. Turner and Dr. Clench served on the Council of the American Malacological Union. Dr. Boss was elected Treasurer of the Institute of Malacology at the American Association for the Advancement of Science meeting in December. He continued as associate editor of the National Shellfish Association, and served on a special *ad hoc* committee for the Smithsonian Institution, which reviewed policies and procedures in the Department of Invertebrate Zoology of the U. S. National Museum. Miss Lawrence served on another advisory committee for the

USNM, this one for the Department of Vertebrate Zoology. Dr. Kummel continued as Treasurer of the Paleontological Society, and Dr. Williams served as Secretary-Treasurer of the Harvard-Radcliffe Chapter of Sigma Xi. Dr. Levi was again the Vice-President of the Centre International de Documentation Arachnologique and a Councillor of the Society of Systematic Zoology. Dr. Paynter again served as editor of the Nuttall Ornithological Club publications and of Peters' Check-list; he was a member of the Editorial Board of the Wilson Ornithological Society and was Associate Editor of the *American Midland Naturalist*. Dr. Romer finished his tour of duty with the American Association for the Advancement of Science in December, retiring as Board Chairman after giving his presidential address at the annual meeting in New York.

TEACHING

Drs. Kummel and Gould gave one joint course, Introduction to Invertebrate Paleontology (Geol. 151), covering the morphology, distribution in time and space, evolution, and paleoecology of fossil invertebrates, and participated in another, Aspects of the Natural Environment (Nat. Sci. 10). In the spring term, Dr. Gould led a graduate seminar in the study of ontogeny in fossils. This included a survey of methods (primarily mathematical) in the study of growth and form and an analysis of the relationship between ontogeny and phylogeny. Two courses that were offered for the first time last year, Biology of the Invertebrates (Biol. 10a) (Dr. Levi) and Biology of the Vertebrates (Biol. 10b) (Dr. Williams) have proved to be very successful; enrollment in both courses has greatly increased this year. Guest lectures were given in Dr. Levi's course by Drs. Boss, Evans, Fell, and Turner; Dr. Williams was assisted in this way by Drs. Lyman, Mead, Paynter, and Prof. Patterson. Because the demand in the area of marine biology was overstraining the freshman seminar program, Dr. Fell offered, at the sugges-

tion of the Department of Biology, a course called Biology of the Sea Floor (Biol. 122), which is suitable for lowerclassmen, although it includes features of interest to both seniors and graduate students. Dr. Fell then raised the level of his original course in this field, Biology of Marine Invertebrates (Biol. 121) and restricted its scope to the systematics and general biology of marine invertebrates; formal instruction in this course was also contributed by Drs. Kummel, Boss, and Turner.

Other courses offered or participated in by staff members were: Biogeography of Animals (Biol. 246: Fell, Mayr, Mead, Patterson, Simpson, Williams); Methods and Principles of Systematic Biology (Biol. 250: Mayr, J. Lawrence, Evans); Biology of Insects (Biol. 127: Carpenter); Biology of Amphibians and Reptiles (Biol. 132: Williams). Graduate research courses were offered by Drs. Boss, Carpenter, Darlington, Evans, Fell, Kummel, B. Lawrence, J. Lawrence, Levi, Lyman, Mayr, Mead, Patterson, Paynter, Simpson, and Williams.

Museum staff members this year supervised the work of 43 graduate students in 10 different departments:

Ichthyology	9
Vertebrate Paleontology	7
Invertebrate Paleontology	6
Arachnology	5
Herpetology	5
Entomology	4
Ornithology	4
Mammalogy	1
Marine Invertebrate Zoology	1
Malacology	1

The degree of Doctor of Philosophy was awarded to six of these students: Jonathan Reiskind (Dr. Levi), *The Spider Subfamily Castianeirinae of North and Central America (Araneae, Clubionidae)*; Robert M. McDowall (Dr. Mead),

The Galaxiid Fishes of New Zealand; Naercio Aquino Menezes (Dr. Mead), *Systematics and Evolution of the Tribe Acestrorhynchini (Pisces, Characidae)*; Susan Smith (Dr. Mayr), *Communication and other Social Behavior in Parus carolinensis;* George Gorman (Dr. Williams), *Studies on the Evolution and Zoogeography of Anolis (Sauria: Iguanidae)*; and Bryan Lovell (Dr. Kummel—shared with R. Siever), *Sandstones of the Eocene Tyee Formation, Oregon Coast Range.*

EXPEDITIONS AND TRAVEL

A highly successful vertebrate paleontology field trip to the Cenozoic of East Africa, led by Professor Patterson (supported by a National Science Foundation grant, GA-425), provided a unique combination of excellent opportunities for field studies, plus prime material for laboratory investigations. Prof. Patterson's field party included Arnold Lewis, Chief Preparator, and William Sill, Roger Wood, Vincent Maglio, and John Wahlert, graduate students. Their work in the vicinity of the Kerio-Kalabatha Junction and Lothagam Hill yielded an extensive collection of reptilian, mammalian, molluscan, and fish fossils. Mr. Wood extended his stay in Africa, supported by grants from the National Geographic Society and Explorer's Club of New York, and has added a large collection of specimens of living turtles from East Africa to the herpetological collection of the Museum. This series of population samples from Uganda and Kenya should be useful in re-evaluating the taxonomy of living forms. Information on species variability so obtained should also help to clarify the inter- and intraspecific diversity represented by the fossil African turtles collected by Prof. Patterson's party.

The Museum's ichthyologists were, as usual, a mobile group. In contrast to former years, Dr. Mead's field activities were in, rather than on, the seas. During the summer of 1967, he participated in dives in the Woods Hole Ocean-

ographic Institution's research submersible "Alvin," giving him an opportunity to observe alive, in their own habitat, the deep-sea fishes long of interest to him. In February and March, through an arrangement between the Smithsonian Institution and E. A. Link of Ocean Systems, Inc., Dr. Mead and his wife, Dr. Earle of Harvard's Farlow Herbarium, were able to dive in, but more importantly from, Ocean System's "Deep Diver" in several localities in the Tongue of the Ocean, Bahamas. The ability to leave this research submersible for first-hand scientific work along the bottom at substantial depths and then to go back to it for decompression and return to the surface makes "Deep Diver" the most exciting new instrument for biological and other oceanic research. Continued collaboration with "Deep Diver" and its associates is being planned, and the Meads express their most sincere gratitude to the Links, Ocean Systems, and the Smithsonian Institute for making possible these initial diving experiments. Several of the graduate students in this department also traveled far afield. A major field effort was completed by Robert McDowall, whose research interests in Southern Hemisphere fishes, particularly those of his native New Zealand, called for comparative studies in southern Chile. Through funding from the National Science Foundation made available to him by Harvard's Committee on Evolutionary Biology, supplemented by a grant from Sigma Xi, he was able to collect and study samples of both the freshwater and coastal faunas of Chile. Through growing collaboration with the Smithsonian Tropical Research Institute, the department's research biologists have been enabled to carry their studies into tropical waters. Robert Topp, who is concerned with the behavior and ecological separation of a series of small shore fishes of the family Pomacentridae, was awarded a fellowship this year from that institution, which provided travel and research funds so that he could study coastal fishes along both shores of Panama. And Ronald C. Baird, through funds granted to Dr. Mead by the National

Science Foundation's U.S.-Japanese program, combined field work in Asia with examination of research material pertinent to his dissertation studies housed in various institutions in various parts of the world—his research stops included Los Angeles, La Jolla, Hawaii, Japan, Copenhagen, and the National Institute of Oceanography in Godalming, England.

The problem of extinctions in the history of life, and especially at the Permo-Triassic boundary, was the focus of Dr. Kummel's 1967 field season. Field studies were carried out in the month of July in the Kap Stosch region of East Greenland, one of the few places in the world where latest Permian and earliest Triassic strata are in superposition. (It has been suggested by some authors that in the Kap Stosch area classical Permian faunal elements survived into the early Triassic.) The project was a co-operative effort by a Danish team (Prof. T. Birkelund, Dr. Eigel Nielsen, Dr. S. Bendix-Almgreen) and an American-Swiss team (Prof. C. Teichert of Kansas, Prof. R. Trumpy of Zürich, and Prof. Kummel). Miss Victoria Kohler, Dr. Kummel's research assistant, was also a member of the American team. The Danes concentrated their efforts on (1) fossil fish faunas of the Permian and Triassic formations and (2) the higher ammonite horizons of the Lower Triassic formations. The American-Swiss team concentrated on the boundary strata of the Permian and Triassic formations. The party was transported to Kap Stosch on the Danish icebreaker, the *Nella Dan*, in a very pleasant eight-day journey from Copenhagen; they were taken out of the area on a PBY flying boat operated by the Danish Air Corps. Dr. Kummel reports that the group was given great help by the Danish Geological Survey (Greenland), which supplied camping gear, etc., by the Danish Sledge Patrol, which operates radio stations along the east coast of Greenland, and by the Danish Air Corps.

In other overseas field work, Dr. Turner's research took her to La Parguera, Puerto Rico, on two occasions. Dr. Levi spent two weeks at the Arago Laboratory of the University

of Paris, located in Banyuls-sur-Mer, in France, to study the spider fauna at the foot of the Pyrenees. In April, Stewart Peck, a graduate student in entomology, spent a couple of weeks on Jamaica collecting cave, soil, and fungus arthropods; among his many interesting specimens were blind roaches, found in one of the caves. In another cave he found an extensive bone deposit, which the paleontologists were excited to hear about. During the month of February, Dr. Lawrence went to Panama, where he collected fungus insects on Barro Colorado Island. Athough it was the middle of the dry season, bracket fungi were abundant, so that he obtained about 200 collections. On the one island more than 50 species of Ciidae were collected, and Dr. Lawrence noted some interesting patterns of host preference; large numbers of Tenebrionidae, other fungus beetles, and hymenopterous parasites were also obtained.

Dr. Lawrence, like many other staff members, also did field research in the United States. He spent two weeks collecting in the Florida Keys, concentrating on the rich hardwood forest on Lignum Vitae Key and an isolated hardwood hammock on Big Pine Key. Eleven species of Ciidae, five of them new, were collected; two of the new species were found only on Lignum Vitae Key, where they were feeding on a large, orange-brown *Fomes.* Most of the ciids displayed West Indian affinities. One species was collected on Bill Find's Key, a tiny island consisting entirely of red mangrove. The summer of 1967 found Dr. Evans, for the third time, at the Jackson Hole Research Station, Wyoming, where he continued his work on the ecology and behavior of the digger wasps that occur in restricted areas of sand along the Snake River. Robert Matthews, a graduate student under Dr. Evans, spent the summer at the Edmund Niles Huyck Preserve in Rensselaerville, New York, collecting and rearing parasitic wasps of the genus *Spathius,* his thesis problem. Dr. Chickering spent two months in Florida, collecting tiny spiders, and Larry Pinter and Fred Coyle, graduate students

working in Dr. Levi's department, collected jumping spiders and trapdoor spiders, respectively, in the west. Finally, Dr. Clench worked at the Ohio State Museum in Columbus, and participated in a pollution survey of several important rivers in Kentucky, Tennessee, and Alabama. This collection trip was a repeat of one made in 1924. As nearly as possible, the same localities were sampled—as might be expected, the preliminary results demonstrate that the fauna has been markedly reduced during the last 40 years; less than one quarter of the species are still living at the localities where they were found in 1924.

Aside from field work, the Museum staff traveled extensively, both abroad and at home, to study collections in other museums, to attend scientific meetings, to lecture, and to consult with colleagues. A brief sampling: Dr. Darlington, with support from the National Science Foundation, made a long-postponed and thoroughly successful visit to the London and Paris museums. Dr. Mayr attended scientific meetings in Williamstown, Mass., Washington, D.C., Balboa, Panama, and Asilomar, California, as well as lecturing in Kentucky, Philadelphia, and elsewhere. Dr. Simpson gave seminars and lectures, consulted with colleagues, and examined collections in the University of Alberta, Edmonton, and the University of California, Berkeley; he took part in a conference at the University of Denver and one by CUEBS in Pacific Grove, California. Dr. Lawrence examined the beetle collections in the Entomology Research Institute in Ottawa, and the insect collections of the Field Museum in Chicago and of Purdue University. Dr. Lyman was invited to the University of Alberta, to lecture on Hibernation as a Sensitive System. And finally, Dr. Turner participated in a workshop in England on the preservation of wood in the marine environment, which was sponsored by the Organization of Economic Cooperation and Development; she also visited the National Museum of Wales, at Cardiff, the Linnean Society of London, and the British Museum (Natural History).

RESEARCH

Research by the staff and graduate students in the Museum was as abundant and diversified as ever this year. Although "systematics," broadly defined, is invariably involved, such research can be listed equally well under various headings, such as evolution, zoogeography, or ecology. Only those investigations will be singled out in this year's somewhat streamlined report that seem to be of particularly broad general interest.

Evolution

Dr. Gould completed his work on the evolution of the Bermudian land snail *Poecilozonites*. Before the advent of man, this genus completely dominated the pulmonate fauna of Bermuda. It had diversified into 3 subgenera and at least 15 species, which occupied ecological roles usually filled by several families in continental situations. It thus forms an interesting parallel to such famous cases of insular evolution as Darwin's finches. Multivariate analysis of 20 selected characters in three species demonstrated fluctuating evolutionary trends during the late Pleistocene that correspond exactly to the advance and retreat of continental ice sheets. In particular, the central stock of *P. bermudensis* gave rise at four separate times during glacial periods to morphologically similar, thin-shelled paedomorphic offshoots. Thin shells were adaptive in the low-calcium soils of glacial epochs.

Dr. E. E. Williams continued his study of evolution in the genus *Anolis*. In collaboration with P. E. Vanzolini of São Paulo, Brazil, he analyzed the geographic variation of multiple characters in the South American *Anolis chrysolepis* complex. This forest anole of ultimate Central American affinities illustrates very well what has been described by many students of the Amazonian fauna. The largely continuous forests of today went through cycles of expansion and contraction during the Pleistocene that greatly favored spe-

ciation. During arid maxima, the forest faunas were separated into a series of localized forest refugia; this facilitated the acquisition of isolating mechanisms in these separated populations. An analysis of species distributions, as well as of geographic variation within species, often permits pinpointing the particular refuge in which a given species or semispecies acquired its peculiarities.

Dr. Darlington continued his analysis of the carabid fauna of New Guinea, based on his recently published revisions. He found, as expected, a striking altitudinal variation in wing reduction: of the 434 lowland species, only about 4 per cent have the wings reduced at all, and most of these are still dimorphic, indicating the recency of the reduction; of the 215 mountain species, 32 per cent have reduced wings, only one being dimorphic; and of the 21 species found above 3,000 meters, 95 per cent are short-winged. These findings have led to a re-evaluation of the phenomenon of wing atrophy in relation to altitude, an evolutionary trend of apparently highly complex causation.

Dr. Simpson completed a major study on the Argyrolagidae, an extinct family of South American marsupials. This group provides one of the most intricate known examples of evolutionary convergence, as the argyrolags have an amazing resemblance in morphology and in inferred behavior to the North American kangaroo rats and also to the Old World jerboas, although they are of widely different ancestry. Among the marsupials, the argyrolags are unique; they differ strongly from any other marsupials known and evidently have been separate from an early date. They represent at least a new superfamily and indicate very basic and wide adaptive radiation of marsupials in South America. Earlier belief that they indicate phylogenetic and zoogeographic relationships between South America and Australia proves to be incorrect.

Dr. Simpson also made a brief study of a North American

fossil marsupial, and obtained materials for further work. Primitive marsupials, opossums in a broad sense, were abundant in North America from the late Cretaceous to the early Miocene, when they died out at least in what is now temperate North America. In the Pleistocene they spread northward again, and a single species is now widespread in the United States. Through cooperation with the University of Colorado and the Carnegie Museum, Dr. Simpson now has large collections from the Oligocene and rare material from the early Miocene that will considerably advance knowledge of this interesting history.

The slowly evolving long-lived bivalves of the superfamily Lucinacea have recently been the object of several studies by Dr. Boss. The anatomy of the Indo-Pacific genus *Fimbria,* whose strong, heavily ribbed shell allows its species to occupy a niche in coarse coralline sand, provides sufficient evidence to relate the monotypic family Fimbriidae to other lucinaceans. Another study deals with their taxonomic rank. Since some fossils in the Ordovician bear a resemblance to *Lucina,* it has been postulated that the lucinoid lineage is so distinct from that of the other higher bivalves that the group merits a singular status in the classificatory hierarchy, namely at the subclass level. Studying the structure of the nervous, excretory, and respiratory systems, Dr. Boss has marshalled evidence to refute such an hypothesis and to show that lucinoids, though adaptively specialized, possess too many features in common with other modern heterodont bivalves to justify their separation at the subclass level.

The freshwater mollusks of Lake Tanganyika, remarkable in their richness and great variety, are the object of a study of the phenomenon of convergence by Dr. Boss. First brought to the attention of western European malacologists by the early explorers Burton and Speke, the unique snails of that great East African lake generated considerable controversy in that they bear strong phenotypic resemblances

to certain marine species. A school of scientists headed by J. E. S. Moore felt that Lake Tanganyika was a *Relikten-See* and that its mollusks were remnants of the marine fauna of a Jurassic sea. Moore's interpretation of the fauna as Mesozoic was largely discredited in his own lifetime, but the contention that Tanganyika had some "marine" aspects thrived for a good portion of the 20th century. Anatomical studies of the spectacular, so-called thalassoid gastropods of Tanganyika indicate that the many species arose autochthonously from a single, rather ancient ancestor belonging to a family of mollusks long associated with fresh water. Although some of the thalassoid species look like the moon-snails or top-shells of the sea, their phenotypic resemblance is convergent. Genetically distinct, widely separated lineages of gastropods have thus given rise to shells whose external structure, including the shape, thickness, and even fine sculpture, are very similar—indeed, almost identical. Preliminary studies by Dr. Boss indicate that the great age of Lake Tanganyika—nearly 2 million years—and its limnological similarities to oceanic conditions have facilitated the convergent evolution of its freshwater snail fauna. Further, although all the thalassoid gastropods are herbivores and feed on vegetative detritus and plants, they occupy distinct ecological niches in the lake, where their particular shellforms are adaptively significant.

Dr. Boss has also studied the phylogeny of coral-boring clams of the genus *Spengleria,* which first appeared in Jurassic times. The genus has always been a dweller in warm, tropical seas. The two Recent species, one from the Caribbean and the other broadly distributed in the Indo-Pacific, arose from a common Tethyan ancestor that became extinct in the Mediterranean area towards the end of the Miocene. Here, as in many other benthic marine invertebrates with planktonic larvae, evolution has proceeded very slowly, without major adaptive breakthroughs.

Dr. Carpenter reports that examination of the Cretaceous

collections in various paleontological museums brought to light a new locality for Cretaceous insects in northern Labrador. These specimens, collected by Professor E. Dorf of Princeton University and turned over to Dr. Carpenter and Prof. A. E. Emerson for study, are of unusual interest, not only because they help fill the Cretaceous gap in the insect record, but because of their geographical position. One is a termite, described by Dr. Emerson, belonging to the family Hodotermitidae; this is the first pre-Tertiary record of a fossil termite. The presence of a basal suture on the wing, as well as other structural details, has convinced Prof. Emerson that this termite already had well-developed social habits. Since this fossil is somewhat older than the Cretaceous ant from New Jersey (*Sphecomyrma*, described in last year's Annual Report), it constitutes the first record of social habits in insects. The other insect from this collection that has been described is a member of the order Neuroptera, and is virtually intermediate in structure between the Jurassic snakeflies, known only from the Soviet Union, and the Tertiary and Recent types. Both these finds add considerably to our understanding of insect phylogeny.

The pattern of evolutionary radiation of Triassic ammonoids after their near extinction in the late Permian is of primary concern and interest to Dr. Kummel. To this end, he continues to receive new collections from all over the world; this past year he has studied materials from Timor, Malaya, Nepal, Japan, and Greenland. His data are as yet incomplete, but what seems to be emerging is the existence of a small, homogeneous, very cosmopolitan fauna in the first zone after the phase of extinction in the late Permian, followed by a gradual increase in number of taxa and a gradual differentiation of the faunas into distinct faunal provinces. The distribution of the latest Scythian (Lower Triassic) ammonoids apparently reflects a faunal gradient from Tethys to the circum-arctic region. This contrasts markedly with the pattern of distribution of the earliest Scythian faunas.

Morphology

A series of studies on the anatomy of Antarctic seals is being carried out under the auspices of Barbara Lawrence. Dr. Jean Piérard has completed a manuscript on the osteology and myology of the Weddell seal, and Dr. Terrance Wilson has collected and embalmed specimens of two other genera, the Ross and the Crabeater seals, which will permit the continuation of these studies.

Mr. James Sprinkle continued his work on relationships among several groups of Paleozoic pelmatazoan echinoderms. He made several new finds and important reinterpretations, in particular a discovery that the so-called "arms" of the Silurian rhombiferan cystoid *Caryocrinites* actually corresponded to the recumbent, brachiole-bearing ambulacra of other members of the group.

Dr. Turner has completed a study on the anatomy of the land snails of Savo Island (Solomons). The similarity of the musculature of the cyclophorid *Leptopoma perlucidum* to that of various species in the Neritidae and the Helicinidae is the most interesting outcome of this work. Species in these last two families have paired retractor muscles, one which inserts on the columella, the other on the outer wall of the body whorl near the suture. In *Leptopoma* the muscle is not divided, but a portion extends between the whorls of the animal to insert on the outer wall of the shell. This structural feature emphasizes the relationship of the lower Mesogastropoda to the Archeogastropoda and suggests avenues for promising comparative studies.

Dr. Turner's anatomical work on the Cuban land snails of the family Helicinidae has shown that the shape, size, and attachment area of the divided columella muscle varies with the species and genus and therefore seems to be of systematic importance; the results of this research are being used to supplement the monographic revisions of helicinid genera by Jacobson and Clench.

Behavior

Dr. Evans continued his work on the behavior of selected species of digger wasps both at Jackson Hole, Wyoming, and in Massachusetts, focussing his attention on the species of *Philanthus.* It so happens that in each area there are five species; thus is provided a basis for a comparative study of nesting behavior in ten different species. There are striking differences in such matters as nest closure and concealment, prey selection, seasonal cycle, and so forth, all of these differences apparently representing adaptations for avoiding competition with other species of the genus or representing diverse modes of reducing the incidence of parasitism by miltogrammine flies.

Several years ago a German student of spiders reported that the mating position of *Scytodes thoracica* (Scytodidae) differed in different areas of Europe. Since mating position was believed to be a very conservative character, hardly varying within a family, it was assumed that he perhaps had similar but different species. A year ago Dr. Levi observed the mating of a species of the related genus *Sicarius* for the first time. He observed it again this spring, in the same pair; during a pause while the female was making an eggcase, the male emerged from the sand and mated with her. To Dr. Levi's surprise, a completely different position (perhaps due to obstacles in the way) was observed in this second mating, a position as far different from the first as are the positions of various European *Scytodes* from one another.

The construction of the eggcase of *Sicarius,* which belongs to a small Southern Hemisphere family, has long been a puzzle. It appears to be made of mud, is attached to a stone, and is sometimes buried in sand. It was first described 70 years ago. Dr. Levi has made two observations and a series of photographs on this eggcase construction. The female throws sand back with her forelegs; then she bends her abdomen down at an angle and rocks it from side to side in the sand

that has been thrown back. She then climbs up to the eggcase foundation, carrying on her abdomen, around the spinnerets, a large discshaped load of sand. Next she weaves, moving in the usual way. Within a short time, the sand has disappeared, apparently bound with silk into the eggcase. After completion of the eggcase, the female walks about 10 cm from it, and with powerful movements of the forelegs throws sand back towards it from various directions, eventually burying it. On examination, females were found to have a crown of long, dense, feathered setae around their spinnerets, not present in males or immature specimens. When the dried abdomen of a dead spider was rocked on sand, only the finest sand grains were picked up; most sand is too coarse to stick. Dr. Levi has noticed that the sand grains incorporated in the eggcase are about 1/10 the size of the average sand in which the spiders are kept. The construction of the eggcase takes several days if the spider is undisturbed; otherwise it takes more than a week. In the periods when she is not working on it, the female submerges in the sand, but she always finds her way back to the eggcase. Since no silk guide lines are made, some orientation and memory must be involved. Orientation has been observed before in these spiders; half-eaten prey is picked up with little searching by the spider emerging from sand.

Ecology

Allen Greer studied the live-bearing habits of the lizards of New Zealand. The few lizards of this island are skinks and geckos, and the geckos are the only known live-bearing members of their family. Just as viviparity has facilitated the northward spread of reptiles in Eurasia, so the acquisition of the live-bearing habit apparently permitted the survival of lizards in New Zealand during the cold periods of the Pleistocene. An increase in the percentage of live-bearing species of lizards and snakes in mountain areas had previously been described for various parts of the world; Greer

has now demonstrated that this also occurs in the highlands of East Africa.

Dr. Turner has continued her studies of the biology and ecology of the ship worms (Teredinidae). Experiments conducted to determine the length of time that the larvae (pediveligers) can remain in plankton showed that *Teredo clappi* and *T. furcifera* were still capable of penetrating wood after 22 days, a much longer time than had been previously expected. It was found that if food is scarce, larvae of *Nototeredo knoxi* remain healthy for over three weeks but do not grow. These long periods of plankton life may be a very important factor in the dispersal of the species. Observations of the larvae at the time of settlement and metamorphosis have shown that not all species of teredinids, as is generally stated, produce a byssus thread, that the surface of the wood must be softened by bacterial and fungal action before the young can penetrate it, and that if the wood has a very fine covering of algal threads, the larvae are less disturbed by currents and are thus more successful in penetrating it. One of the major problems in working on the biology of the teredinids is the difficulty of keeping the animals alive outside of wood, which is necessary both for positive identification of the species and for breeding and feeding experiments. *Nototeredo knoxi* was kept alive for over a month in Puerto Rico and, at present, *Bankia fimbriatula* (from Florida) and *Lyrodus "pedicellatus"* (from California) have been living in petri dishes for a number of weeks at Nahant. They all produce a calcareous tube around the base of the siphons, and some spawned after a week in a "micro-aquarium." One specimen, the posterior third of which had been amputated, regenerated abnormal but functional siphons.

Zoogeography

Dr. Fell continued his studies of the distribution of marine populations in present and former seas, concentrating particularly upon a statistical analysis of distribution patterns.

Two principal computer programs were written. One is based on the assumption that ocean currents are responsible for the observed distribution patterns, and the other yields coordinates of reference points on the margins of the continents. In this way a series of 45 map projections was drawn, to serve as an atlas of biogeography for former geological periods. In this work Dr. Fell was greatly assisted by Frederick Ris, a mathematics senior who has since been awarded a Rhodes Scholarship. Subsequently, new methods were tested through an analysis of Recent terrestrial faunas. The object of these studies is to determine to what extent mathematical theorems can be usefully applied to zoogeographic research.

How careful the zoogeographer must be not to base his conclusions on obsolete data was demonstrated by Dr. E. E. Williams. A review of our present knowledge of the Cuban herpetofauna as compared with the latest previous summary (by Barbour in 1937) reveals an extraordinary increase in the number of recognized species: a more than 70 per cent increase for frogs (38 species rather than 22), an almost 25 per cent increase for lizards, and a more than 35 per cent increase for snakes. Dr. Mayr undertook a somewhat similar analysis of the history of discovery of African species of birds, but found that most of these were already known 100 years ago. There are 530 species of Non-Passerine birds of which the type locality of the nominate subspecies is in Africa; 435 of these (82%) had been described by 1874, and only 11 species (2%) were added in the last 44 years (since 1924). The inventory of no other large group of animals is even nearly as complete as is that of birds.

Dr. Darlington continued his analysis of the zoogeography of the New Guinea carabids. The most exciting addition to this fauna is the tribe Leleupidiini (with two species). These are small, flightless carabids, which are extraordinarily like ants. The first known member of this tribe was described as recently as 1951, from Africa, but some additional forms have

since been reported from widely scattered localities in Africa and southeastern Asia. They apparently live in leaf litter on the floor of the rain forest, and it is possible that they may mimic the small ants that forage there; so far, however, nothing is surely known of their life histories or behavior. The number of full species of Carabidae now known from New Guinea is 667. Of these, 434 comprise the lowland fauna (species recorded below 500 meters); 161 of the lowland species occur also in the mountains (above 1000 meters); and 215 species have been found only above 1000 meters. Of the latter, only 21 have been found as high as 3000 meters, and only two species extend to the highest known altitudinal limit of carabids, 4,250 meters. Although the carabids of Madagascar are giants, the characteristic New Guinea species are all small, 89 per cent of them being half an inch long or less, and none exceeding one inch in length. The size distribution of lowland Carabidae in New Guinea is curiously bi-modal, with modes at 2.0-2.95 and 6.0-6.95 mm mean length. Although there are other possibilities, Dr. Darlington now thinks that the explanation is that very small species of a single dominant genus, *Tachys,* have flooded into New Guinea relatively recently, imposing a second mode (that at 2.0-2.95 mm) on what is otherwise a single-mode size distribution.

Dr. Boss has analyzed the zoogeography and phylogeny of the bivalves of the family Vesicomyidae in a monographic revision. These animals are widely distributed throughout the world and have been collected by almost every major deep-sea expedition. With the materials of many of the world's museums at hand, five distinct lineages, actually constituting separate genera, can be recognized; each of these has geographically isolated species. Those species that are eurybenthic—with great depth-ranges—are the most widely distributed; the stenobenthic species are isolated in specific oceanic basins. The fossil record of this family gives clues to its recent distribution. Thus, the Eocene species of Peru,

found in rocks whose lithology corresponds to a modern habitat of soft, fine, black mud, are ancestors of certain eastern Pacific-Caribbean species-pairs that once were commonly distributed in both the Atlantic and Pacific oceans by means of the Colombian portal.

Mr. Richard Johnson completed a systematic study of Unionacea of the Apalachicolan and Southern Atlantic Slope regions. The zoogeographical results of this investigation indicate that the unio fauna of the Apalachicolan region, thought to be largely endemic, is derived from the West and that, further, some of these species entered the Southern Atlantic Slope region through a confluence of the Apalachicola and Savannah river systems.

Physiology and Biochemistry

Dr. Lyman continued his studies on the mechanisms by which the hibernating mammal becomes reactivated. How does it respond to an external stimulus and start the complex and coordinated physiological changes that permit the animal to warm itself and become active? When a hibernating individual is disturbed, the first measurable change is a burst of muscular activity that can be recorded electrically but does not necessarily result in visible muscular contraction. This is followed by acceleration of the heart beat and subsequent arousal. Dr. Lyman has shown that the muscular activity is the result of a spinal reflex. Animals may hibernate at temperatures between 15 and 2° C; the colder they are, the more violent and prolonged is the muscular activity from a single stimulus. Neurophysiological studies by others have shown that the spinal reflex in non-hibernating mammals is increased in both intensity and duration as the animal chills, but that cold blocks the reflex completely below about 18° C. Mammals that hibernate are peculiar in that nervous conduction continues to nearly the freezing point of water. Evidently the exaggerated spinal reflex seen in the animal during hibernation is an amplified form of that described in

chilled, non-hibernating animals. Thus the spinal reflexes of the hibernator become more responsive as the animal becomes colder, and the hibernator has a "built-in" protective device, common to both hibernators and non-hibernators, in the reaction of its nervous system to cold.

Dr. Turner, in collaboration with Dr. Frederick Rosenberg, marine bacteriologist at Northeastern University, initiated research to determine whether shipworms (teredinids) have an endocellulase or whether the reduction of the wood is accomplished by cellulolytic bacteria. To this end, intact organs (stomach, intestine, and caecum), dissected from several species, were used to culture cellulolytic bacteria. Though the determination of the bacteria is not complete, the same general types were found in the intact organs, on the wood from which the animals were collected, and in the sea water. This suggests that the bacteria, which are free in the water, are also on the wood, so that the bacteria are taken into the gut with the first wood ingested when the young larvae settle, and that the ancestral teredinids were probably opportunistic in making use of the activity of the bacteria. This further suggests that the caecum probably was not present in the early teredinids but evolved slowly. The anatomy of the living species supports this theory, for *Kuphus arenaria,* the most generalized of the teredinids, lacks a caecum; species of *Teredora* and *Uperotus* with large gills have a small caecum; whereas species of *Neoteredo* and *Nausitora* that have small gills (and hence reduced ability for filter feeding) have a very large caecum. There is still much disagreement about the means by which teredinids utilize wood; however, the results of Dr. Turner's preliminary research, supported by anatomical studies, indicate that the cellulase is provided by bacteria.

Taxonomy

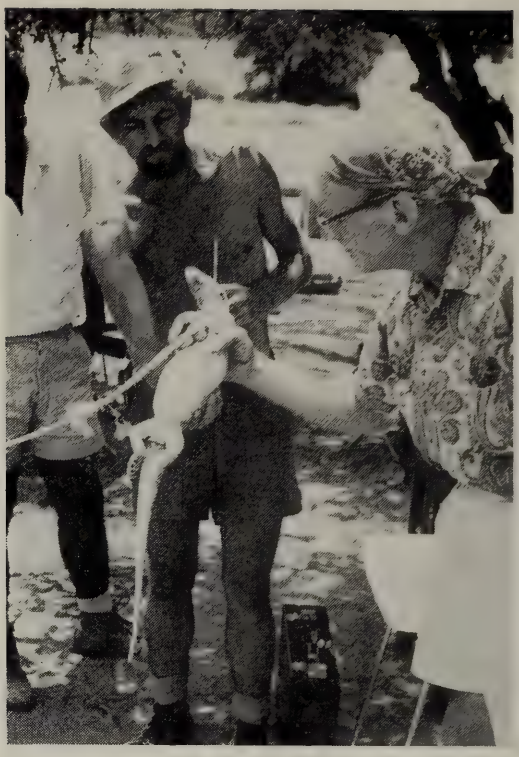
Dr. Romer was able to clarify the taxonomic status of a puzzling fossil from the Texas Permian. *Pantylus,* known

from skull material for nearly a century, has been generally claimed to be a reptile, although there were suggestions of affinity with microsaurs, an amphibian group thought by many to be related to reptile ancestry. Dr. Romer's study of the skull by the serial section method shows that it is indeed a microsaur, not a reptile; further, it shows that the microsaurs cannot be considered as in any way ancestral to reptiles.

Dr. Evans has completed a revision of bethylid wasps of the genus *Epyris* in the Americas. These are among the most commonly encountered members of this family and are important natural enemies of the larvae of darkling beetles (Tenebrionidae). As a result of his studies, the number of known American species has been increased from 36 to 73. Dr. Evans reports that the introduction of Malaise traps within the past few years has greatly extended our knowledge of these and other insects. These traps (invented by the Swedish entomologist René Malaise) are unbaited, tent-like collecting devices. Their effectiveness is shown dramatically by our knowledge of the bethylid fauna of Argentina. A few years ago the collections at the Instituto Miguel Lillo at Tucumán contained two specimens. In the past two years Dr. Lionel Stange of that institution has sent to Dr. Evans more than 1500 specimens taken in Malaise traps, increasing the number of specimens 750-fold and the number of known species from Argentina by at least 10-fold. Several Malaise traps set up at the Museum's field station in Bedford, Massachusetts, have produced innumerable new records of Hymenoptera and have added to the available material of several undescribed Bethylidae.

Barbara Lawrence completed a cranial analysis of the wild canid population of New Hampshire, in collaboration with W. H. Bossert. Techniques used in a previous multiple-character analysis of wolves, coyotes, and dogs have produced evidence that these puzzling animals are predominantly, but not typically, coyote. While there is evidence

Dr. Turner (left) and Dr. Mead (right), with a colleague, hunting for and photographing fish and invertebrates. They are 120 feet below the surface on Sunken Reef, 7 miles off La Parguera, Puerto Rico.



African field season, 1967. *Top:* Vincent Maglio, William Sill, and Professor Patterson examining a monitor lizard caught at the camp in Lothagam. *Bottom:* Roger Wood working on a prize fossil turtle.

Top: Arnold Lewis working on a block containing a fossil horse skull found at Lothagam. *Bottom:* Prof. Patterson, Mr. Sill, and a member of the crew digging a well in the dry bed of the Lomunyenkuperat River.

that dog or wolf genes were added at some time during the spread of coyotes from Minnesota to New England, there is no evidence that the population as a whole is the result of any current dog-coyote interbreeding. These conclusions are supported by a detailed report on the growth and development of behavior in these animals, undertaken, as part of the same project, by H. and W. Silver of the New Hampshire Fish and Game Commission.

Dr. E. E. Williams and his associates have clarified various problems of reptile taxonomy. For example, George Gorman, in collaboration with Dr. Williams and R. Huey, was able to show that the lizard genus *Polychroides,* described by its author G. K. Noble as of uncertain affinities, has chromosomal characteristics of the genus *Polychrus*; this agrees with the osteological findings of R. Etheridge. Dr. Williams, with Richard Estes and Thomas Frazzetta, has completed a study of the skull of the oldest known fossil snake, *Dinilysia patagonica* from the Cretaceous of Argentina. As might be expected, this oldest-known snake shows some striking resemblances to lizards. It has, however, some marked specializations of its own and, although it strongly resembles one group of primitive snakes (the semi-burrowing *Cylindrophis-Anilius* group), its lizard-like features are not similar to the features of any particular group of lizards; it is probably already too advanced. Allen Greer finished his revision of the subfamilial classification of scincid lizards, the largest and most diverse group of lizards existing today. The use of both skull characters and external morphology permits the recognition of well-defined phyletic units. The most primitive subfamily, the Scincinae, has a relict distribution in southern Asia; it has been to a large extent replaced there by the lygosomines, the most advanced subfamily, whose major center of abundance and highest differentiation is, however, in the Australian region.

William Hall, III, in the course of investigation of karyotypes in the family Agamidae, has discovered an all female

population of the genus *Leiolepis* with a chromosome pattern strongly suggestive of triploidy. Mr. Hall's preparation of the New Guinea lygosomine skink *Sphenomorphus flavipes* for chromosome study revealed the presence of green pigment in the plasma. Independently, George Gorman discovered green blood in the New Guinea skink *Scincella prehensicauda* and Preston Webster in the Solomons form *Lipinia virens anolis.* The chemical composition of the pigment, which occurs in the plasma, is not yet known (in the few frogs that are known to have green blood, it is a bile pigment). Allen Greer believes that these three species, each currently referred to a separate genus, are in fact a natural group. All are arboreal, and all have prehensile tails and well-developed adhesive toe pads of a distinctive type. The histology of the pads is being investigated by P. F. A. Maderson in collaboration with Greer.

Dr. J. Lawrence has completed his work on the biosystematics of the genera and species of Ciidae occurring in America north of Mexico. His report will include 81 species (14 new) in 11 genera; four genera and 27 species have been placed in synonymy. The paper will contain keys to all genera and species, as well as discussions of zoogeography and life history. Studies of the male genitalia have provided several clues to relationships (genera and species groups) and have revealed a species complex within what was formerly known as *Cis creberrimus* Mellie. The European species *Hadraule elongatula* (Gyll.) has recently been collected in New Brunswick, and several new West Indian species have turned up on the Florida Keys. In his work on beetle classification, Dr. Lawrence has reconsidered the taxonomic position of *Aculagnathus* Oke and reviewed the family Cerylonidae. The peculiar species *Aculagnathus mirabilis* Oke has piercing-sucking mouthparts and is found with ants in southeastern Australia. An examination of the type specimen revealed that the species, formerly included in a separate family, is a highly modified cerylonid.

Many years ago a then promising young malacologist, William Healey Dall (1845-1927), worked in the MCZ and wrote up the mollusks collected during the cruises of the *Blake* and *Albatross* while he was honorary curator at the Smithsonian Institution. Throughout his life he contributed voluminously to the body of descriptive work published on mollusks during the late 19th and early 20th centuries. He published well over 1000 articles on natural history and described nearly 5000 species. A bibliography of his descriptive papers and a catalogue of his zoological taxa have now been compiled by Dr. Boss, in collaboration with Dr. Joseph Rosewater and Mrs. Florence Ruhoff of the U. S. National Museum.

Dr. Turner has continued work on a monograph of the Xylophaginae. Specimens taken from dredged wood and from test boards received this year have added not only new distribution records for several species, but three new species and even a new subgenus. The unusual feature of the new subgenus is the presence of siphonal plates that appear to be homologous to the siphonoplax of other groups of pholads, but differ in that the siphonal retractor muscles insert on them instead of on the shell; this is probably correlated with the elongate body of the species in this new subgenus. These are from very deep water, both from the West Indies and the West coast of Africa. Another new, elongate, teredinid-like species has two long brood pouches in the incurrent canal. The young pediveligers of this species are attached to the ventral rather than the dorsal surface of the adult, unlike other species that retain the young in the burrow. This new material shows that the Xylophaginae are as varied structurally as are the Teredinidae, and that much more material is needed before definite evolutionary trends in this group can be recognized.

Mr. José Stuardo has completed his Ph.D. thesis on the phylogeny, zoogeography, and systematics of the bivalve family Limidae, more commonly known as file-shells. This

group, related to the well-known scallops, consists of nearly 200 species. After a study of thousands of samples and the dissection of hundreds of preserved animals, Mr. Stuardo was able to work out the natural relationships in this family. Two distinct subfamilies, one sufficiently diversified for the establishment of two included tribes, have been recognized. Many new species and subspecies were discovered during this revision, and the pattern of distribution of species groups was established. This permitted the arrangement of the previously named and new species taxa in species groups, superspecies, and polytypic species.

General Biology

Dr. Simpson completed a book of essays, some revised from earlier journal publications and some newly written. This volume will probably be published under the title *Biology and Man.* It considers the present status of the biological sciences, their philosophy and impact, the biological nature of man, his present and possible future evolution, and biological implications for ethics. Work on an *Introduction to Biology,* abridged and revised from *Life* by Simpson and Beck, was completed and is now in final proof.

Dr. Mayr completed the manuscript of a new text, *Principles of Systematic Zoology,* an outgrowth of the earlier textbook by Mayr, Linsley, and Usinger (1953). The volume was seen through all stages of proof reading, and should be available in the late fall of 1968. Dr. Mayr also prepared several essays on the philosophy of biology and on the history of biology. In these he stressed the particular role played by biology within the sciences and the differences in conceptual framework between the physical and the biological sciences.

LECTURES AND SEMINARS

Harvard University's Alexander Agassiz Lectures were given this year by Professor Emil L. Smith, of the Depart-

ment of Biological Chemistry, School of Medicine, University of California, Los Angeles. The two lectures, with a general title of *Protein Structure and Evolution*, were individually entitled *Species Differences: Lessons from Cytochrome C*, and *Development of New Structures and Functions.*

The study of chromosomes is becoming an increasingly important tool of the taxonomist. Because Harvard has no resident chromosomal cytologist, the Museum invited the distinguished Australian cytologist and geneticist, Professor M. J. D. White of the University of Melbourne, to spend the months of March, April, and May here as Alexander Agassiz Visiting Professor of Zoology. Prof. White lectured on population cytology, discussed his own research, and gave a series of workshops, open to graduate students and interested staff members, in chromosome interpretation. His first lecture was in the Museum's Natural History Seminar series, and was entitled *Models and Theories of Speciation in a Group of Flightless Australian Grasshoppers.* He then presented a most interesting series of four formal lectures: (1) *Chromosomal Rearrangements and Karyotype Evolution in Grasshoppers*; (2) *The Cytogenetic System of a Parthenogenetic Species of Grasshopper, as Revealed by Tritiated Thymidine Autoradiography and Other Techniques*; (3) *The Evolution of the Meiotic Mechanism*; and (4) *The Role of Inversion Polymorphisms in the Determination of Size and Viability in an Australian Grasshopper—Heterosis or Annidation?*

The Natural History Seminars sponsored by the Museum have been for some years an important weekly event. About half of this year's speakers were members of the Harvard faculty or the Museum staff; the other half came from widely separated institutions—from Oxford University; the University of British Columbia; the Zoological Institute, University of Lund, Sweden; Commonwealth Scientific and Industrial Research Organization, Canberra, Australia; the Smithsonian Tropical Research Institute on Barro Colorado Island,

Canal Zone; University of Strasbourg; Dalhousie University; the University of Melbourne; and, in the U. S., from Johns Hopkins University, Boston University, the Institute of Marine Science of the University of Miami, and Cornell University. The subjects presented were equally wide-ranging. A complete list of the lectures is appended to this report; a few samples here will suffice to illustrate their diversity: *African Mammals in the Fossil Record; An Experiment on the Evolution of Mimetic Patterns in Butterflies; The Application of Spectral Changes in Submarine Light to Ecological Problems; Emperor and Adelie Penguins of Ross Island, Antarctica; Old Maids and Worker Wasps: Contributions to a Theory of Social Evolution.*

PUBLICATIONS

As usual, Museum staff and students were most prolific authors this year; the number of printed pages by Museum writers was even greater than that of last year. There were some 160 publications, with a total of approximately 2102 pages (exclusive of books and of articles still in press). About 131 of these were reports of completed research or other writings of a strictly scientific nature; 15 were reviews of books; the remainder were either of a more general or a popular nature. There were several new editions of books written by our staff, and several translations; notable was the translation into German of Dr. Mayr's *Animal Species and Evolution,* and into Spanish of Dr. Simpson's *Life of the Past.* Wiley has published, as *Invertebrate Zoology,* the translation and adaptation by Dr. and Mrs. Levi of the first volume of A. Kaestner's *Lehrbuch der Speziellen Zoologie.* Dr. Romer's new book, a popular account of animal evolution called *The Procession of Life,* was published in London by Weidenfeld and Nicholson.

There were 13 numbers of the *MCZ Bulletin* (totalling 509 pages) this year, and 25 numbers of *Breviora* (414 pages), again a page increase over last year. The Museum

sponsored four papers in *Psyche,* and one number of *Johnsonia* was published.

COLLECTIONS

The growth of a research collection is always a reflection of the interests of those associated with the particular department. Additions to the collections of the Fish Department have been, as always, both selective and substantial this year. They include extremely valuable mesopelagic fish and cephalopod collections from off central Chile taken during Cruise XIII of the National Science Foundation vessel "Anton Brunn"; freshwater and coastal fishes from Chile, India, and the Amazon, collected by graduate students McDowall, Baird, and Menezes, respectively; and collections from oceanic waters taken during the Atlantic activities of the Woods Hole Oceanographic Institution. Again as always, investigators elsewhere have chosen to deposit a part of their research materials here; among such during the past year were James E. Böhlke, Royal D. Suttkus, Harvey Bullis, Jr., and Sylvia A. Earle.

Space prohibits the listing of all those who have so generously contributed specimens to augment the collections in the Department of Reptiles and Amphibians. With the aid of a grant from the Milton Fund, slightly more than 14,000 specimens were catalogued and added to the study collections during the year. As in past years, the most important additions were the New Guinea collections provided by Fred Parker. Material also was received from New England, southeastern and southwestern United States, Mexico, Panama, Colombia, Ecuador, Peru, Bolivia, Venezuela, Trinidad, Puerto Rico, Bermuda, Jamaica, St. Vincent, and Israel. Exchanges were received from the University of San Marcos, Peru, the Universities of Kansas and Southern California, and the Field Museum of Natural History, Chicago.

In the Bird Department, the skin collections were increased by approximately 1,000 specimens from Chile, 20

from Russia, and miscellaneous collections of roughly 100 birds. Two hundred twenty-eight skeletons were prepared and catalogued.

The Invertebrate Paleontology Department has embarked upon a long-range program to put their extensive collection drawers (15,000) in order. Many sections of the collection have not been touched since R. T. Jackson's indefatigable curatorial work as a graduate student under Hyatt in the 1880s. Staff and graduate students spent several Saturday mornings taking inventory and consolidating resources by the disposal of unlabelled and other useless material. The stratigraphic part of the collection, now scattered about in several rooms, will soon be ordered geologically and put in one place. Workers in the department are going through the systematic collection group by group, dusting, reboxing, placing labels in plastic envelopes, and recurating, as far as is possible, to modernize Louis Agassiz's nomenclature. A major part of this program involves the separation and cataloguing of type material that is now mixed in with the regular collection. All of the coelenterate types have been separated, the brachiopods are nearly done, and work has begun on the mollusks. The department has made a practice of hiring Antioch College students as full-time curatorial assistants for three-month periods; this has been extremely helpful, as it provides a needed continuity that could never be obtained by the hiring of many Harvard students for various durations of part-time work. In six months, two Antioch students almost completed the recurating of the entire brachiopod collection.

An extensive series of preserved marine benthic mollusks, particularly scaphopods and bivalves, has been processed, catalogued, and incorporated into the collection of the Mollusk Department. These were collected by Dr. John Day of Cape Town, while he was a Visiting Professor at Duke University. All of the samples, quantitatively collected from the "R/V Eastward," were taken during a systematic transect of

the continental shelf off Cape Hatteras, North Carolina. Collections of land mollusks from such widely separated islands as New Guinea in the East Indies and Saba in the West Indies have also been received. Substantial series of freshwater mollusks have been forthcoming from the joint efforts of the department and Dr. David Stansberry of the Ohio State Museum in Columbus. Particularly important are representative species of the eastern great basin drainage system of the Ohio and Tennessee river systems that are threatened by extinction. The extensive collections of R. W. Foster from Cooke Island, the Fiji Islands, and Madagascar, as well as those of S. L. H. Fuller from Tanzania and of G. Moore from Thailand have largely been identified and are being processed.

Dr. Carpenter reports that Mr. and Mrs. Walter Dabasinskas of Cicero, Illinois, have donated several interesting and unusual specimens of insects in ironstone nodules from Illinois. And Dr. Evans's department has received from Dr. Charles Porter some 30,000 specimens from South America, mainly from Argentina.

LIBRARY

The Museum Library houses an important and ever-increasing collection of reference works and serves a large community; our statistics report over 11,000 users of the library last year and more than 9,000 loans made. New acquisitions numbered 1,262, of which 298 were gifts; the others were purchased or were received through exchange. Under Mrs. Hill's direction, work is proceeding on much needed cataloguing, with the library staff gradually working through the large backlog of materials accumulated but not catalogued in past years. They are also going through the entire library, room by room (in order of greatest need), shelf-reading, shifting, and cleaning. Progress is slow, and will continue to be, especially since shelf-reading is turning up many items without shelf cards or catalogue cards—which,

of course, adds to the backlog of materials waiting for cataloguing. During the year, one room of the library was painted, and new flooring and lighting were installed.

A new project, begun in January, is the cataloguing and storing of the many paintings, drawings, and objets d'art owned by the Library. Included in the mass of materials that had been randomly stored throughout the Library were some original watercolors and drawings by Jacques Burkhardt and James Henry Emerton. Two etchings of Louis Agassiz by Sidney Smith were found. On one of these was a notation that they were part of a limited edition of 64 prints, and that the plate had been destroyed; a few weeks later, the original plate was found in the Library. A student assistant, who is interested in both the history of science and in art, has been working on the picture collection; he has proved to be very good at researching unsigned pictures. Some 200 items have been catalogued to date. Six items have been sent to the Fogg Museum for restoration, cleaning, matting, and framing; the Library staff is working on others, re-matting them and protecting them with acid-free envelopes and mulberry paper.

During the year the G. K. Hall Company published the Catalogue of the Library; this eight-volume set is proving to be of great value. The Library staff is making extra cards for all items newly catalogued for a possible future supplement. There were 1,337 such cards made this year.

EXHIBITS AND MUSEUM SHOP

The resignation of Mr. Joseph O'Leary, Museum Exhibits Preparator for the past eleven years, effectively halted work on all the exhibits in February. Before that time, however, the long process of complete refurbishment of the Holarctic Room was finished, except for label preparation, and work was begun on the fossil invertebrate exhibit. Other projects were of a minor nature, but were necessary for the proper maintenance of the exhibits. To replace Mr. O'Leary proved

to be a difficult task, but this spring a contract was signed with Mr. Harold F. Holland, of Vancouver, B.C. Mr. Holland will be officially beginning his career with us, having received his Certificate in Museology from Vancouver City College just this year, but he has worked voluntarily and quite extensively in museums in British Columbia, and we are looking forward to his arrival.

Another resignation in this department was that of Mrs. Max Hall, who had operated the Museum Shop almost from its start eight years ago. We shall greatly miss her enthusiasm and creativity. In its last year of operation under her capable direction, the Shop showed a ten per cent increase in gross income, which was sufficient both to offset its rising operating costs and to provide a modest profit to be put toward work on the exhibits. The Shop has always been a most important feature of the exhibits section of this Museum; young visitors by the droves are welcomed there, their questions answered, and their visit to the Museum enhanced by the kind and interested attention of the Shop personnel. We are looking forward to the Shop's continuing prosperity under its new manager, Mrs. Thomas M. Kivney, who was appointed in the spring to replace Mrs. Hall.

ACKNOWLEDGMENTS

A memorial fund has been established by her friends in honor of Dr. Tilly Edinger. Dr. Edinger, whose accidental death in May, 1967, was recorded in last year's Annual Report, was for many years a Research Paleontologist in the Museum and was, at the time of her death, an Honorary Associate in Vertebrate Paleontology; the money from the fund is being used to purchase books in her field for the Museum library. Mrs. Margaret Colbert has designed a handsome bookplate, and the books are a fitting tribute to Dr. Edinger, who was a dedicated and able scientist, as well as a very dear friend to many.

We are grateful to the interested friends and associates of

the Museum, who have, as always, augmented our collections, given generously of their time, and contributed to our resources. We are particularly indebted to the following:

For valuable additions to our collections:

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Vol. 136

No. 1. The theridiid spider fauna of Chile. By Herbert W. Levi. Pp. 1-20, 29 September 1967.

No. 2. Habitat observations, records, and new South American theridiid spiders (Araneae, Theridiidae). By Herbert W. Levi. Pp. 21-38, 29 September 1967.

No. 3. The Tertiary lorisiform primates of Africa. By George Gaylord Simpson. Pp. 39-62, 29 September 1967.

No. 4. The Ameghinos' localities for early Cenozoic mammals in Patagonia. By George Gaylord Simpson. Pp. 63-76, 29 September 1967.

No. 5. A study of the effects of expatriation on the gonads of two myctophid fishes in the North Atlantic Ocean. By William T. O'Day and Basil Nafpaktitis. Pp. 77-90, 29 September 1967.

No. 6. Delimitation of the genus *Ceracis* (Coleoptera: Ciidae) with a revision of North American species. By John F. Lawrence. Pp. 91-144, 14 November 1967.

No. 7. Systematics and evolution of the genus *Triodopsis* (Mollusca: Pulmonata: Polygyridae). By Joseph Vagvolgyi. Pp. 145-254, 12 February 1968.

No. 8. Pipid frogs from the early Cretaceous of Israel and pipid evolution. By Eviatar Nevo. Pp. 255-318, 12 February 1968.

No. 9. The spider genera *Gea* and *Argiope* in America (Araneae: Araneidae). By Herbert W. Levi. Pp. 319-352, 15 April 1968.

No. 10. Lichomolgid copepods (Cyclopoida) associated with corals in Madagascar. By Arthur G. Humes and Ju-Shey Ho. Pp. 353-414, 15 April 1968.

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No. 12. A re-examination of the snake genus *Lycophidion* Duméril and Bibron. By R. F. Laurent. Pp. 461-482, 29 May 1968.

No. 13. Additional Scythian ammonoids from Afghanistan. By Bernhard Kummel. Pp. 483-509, 29 May 1968.

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No. 271. *Chelonia depressa* Garman re-investigated. By Ernest E. Williams, Alice G. C. Grandison, and Archie F. Carr, Jr. 15 pp., 17 November 1967.

No. 272. The ecological distribution of the anoline lizards around Kingston, Jamaica. By A. Stanley Rand. 18 pp., 17 November 1967.

No. 273. Studies on neotropical Pompilidae (Hymenoptera). III. Additional notes on *Epipompilus* Kohl. By Howard E. Evans. 15 pp., 17 November 1967.

No. 274. The genus *Nops* (Araneae, Caponiidae) in Panama and the West Indies. By Arthur M. Chickering. 19 pp., 17 November 1967.

No. 275. A new scincid lizard from the northern Solomon Islands. By Allen E. Greer and Fred Parker. 20 pp., 17 November 1967.

No. 276. The generic relationships of the African scincid genus *Eumecia*. By Allen E. Greer. 9 pp., 24 November 1967.

No. 277. *Lestidium bigelowi*, a new species of paralepidid fish with photophores. By Michael J. F. Graae. 10 pp., 24 November 1967.

No. 278. Notes on the emberizine sparrow *Rhynchospiza stolzmanni*. By Raymond A. Paynter, Jr. 6 pp., 24 November 1967.

No. 279. A second skink with fragmented head scales from Bougainville, Solomon Islands. By Allen E. Greer and Fred Parker. 12 pp., 24 November 1967.

No. 280. The *notatus* group of *Sphaerodactylus* (Sauria, Gekkonidae) in Hispaniola. By Benjamin Shreve. 28 pp., 19 March 1968.

No. 281. Additional notes on batoid fishes from the western Atlantic. By Henry B. Bigelow and William C. Schroeder. 23 pp., 5 April 1968.

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No. 286. The status of *Nesogalaxias neocaledonicus* (Weber and de Beaufort) (Pisces, Galaxiidae). By R. M. McDowall. 8 pp., 5 April 1968.

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No. 291. A new species of *Tribolonotus* (Lacertilia: Scincidae) from Bougainville and Buka, Solomon Islands, with comments on the biology of the genus. By Allen E. Greer and Fred Parker. 23 pp., 29 May 1968.

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Vol. 73

No. 4. A new species of myrmecophilous Coccinellidae, with notes on other Hyperaspini (Coleoptera). By Edward A. Chapin. Pp. 278-282, December 1966.

Vol. 74

No. 1. A new species of *Trachysphyrus* from the Andes of Ecuador (Hymenoptera, Ichneumonidae). By Charles C. Porter. Pp. 27-33, March 1967.

No. 3. Notes on the biology of two Central American *Ptinus* (Coleoptera: Ptinidae) with a description of a new species. By Robin M. Andrews. Pp. 191-202, September 1967.

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Vol. 4

No. 46. The subfamily Tellininae in the Western Atlantic Ocean. The genera *Tellina* (Part II) and *Tellidora*. By K. J. Boss. Pp. 273-344.

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Appendix I

NATURAL HISTORY SEMINARS
1967-1968

October 11: Dr. J. A. L. Cooke (Oxford University), *Color Films on Spider Behavior.*

October 18: Dr. Jan E. Efford (University of British Columbia), *The Recruitment of Young in Certain Marine Populations.*

November 1: Dr. John F. Lawrence (Harvard University), *Evolution of Myrmecophily in the Ptinidae (Coleoptera).*

November 8: Dr. Kenneth R. H. Read (Boston University), *Underwater Cinematography. Two Expeditions to the Caribbean. Time-Lapse Movies of Local Marine Organisms.*

November 15: Dr. Howard E. Evans (Harvard University), *Instances of Dual Sex-Limited Mimicry in the Wasps.* Mr. Robert W. Matthews (Harvard University), *Notes on the Biology of* Microstigmus comes (*Hymenoptera: Sphecidae*) *from Costa Rica.*

November 22: Professor Carl H. Lindroth (Zoological Institute, University of Lund, Sweden), *Colonization of New Land. Investigation of Surtsey Island, Iceland.*

November 29: Mr. John C. Boyd (Johns Hopkins University), *Emperor and Adelie Penguins of Ross Island, Antarctica.*

December 13: Dr. Barry P. Moore (Commonwealth Scientific and Industrial Research Organization, Canberra, Australia), *Progress and Problems in the Study of Australian Beetles.*

December 20: Mr. Mahlon Kelly (Harvard University), *The Ecology of Dinoflagellate Luminescence.*

January 10: Dr. Michael H. Robinson (Smithsonian Tropical Research Institute, Barro Colorado Island, Canal Zone), *Sequential Responses in the Prey-Capture Behavior of the Spider* Argiope argentata.

February 7: Dr. H. R. Buchli (University of Strasbourg), *Biology of Trapdoor Spiders.*

February 14: Dr. Ray S. Birdsong (Institute of Marine Science, University of Miami), *The Systematics of Gobioid Fishes.*

February 21: Dr. Mary Jane West Eberhard (Harvard University), *Old Maids and Worker Wasps: Contributions to a Theory of Social Evolution.*

February 28: Mr. Allen Greer (Harvard University), *The Evolution of Scincid Lizards* or *How I Learned to Live Without* Anolis.

March 6: Dr. H. B. S. Cooke (Dalhousie University), *African Mammals in the Fossil Record.*

March 13: Professor A. S. Romer (Museum of Comparative Zoology), *Argentinian Triassic Reptiles. Gondwanaland?*

March 20: Dr. Michael White (University of Melbourne), *Models and Theories of Speciation in a Group of Flightless Australian Grasshoppers.*

March 27: Dr. S. J. Gould (Museum of Comparative Zoology), *Irreversibility and the Status of Evolutionary Laws: Louis Dollo's Formulation of Dollo's Law.*

April 10: Mr. John Alcock (Harvard University), *An Experiment on the Evolution of Mimetic Patterns in Butterflies.*

April 17: Mr. Robert M. McDowall (Harvard University), *Life History and Distributional Patterns in Galaxiid Fishes.*

April 24: Mrs. Susan Smith (Harvard University), *Vocal Communication in the Carolina Chickadee.*

May 1: Professor George L. Clarke (Harvard University), *The Application of Spectral Changes in Submarine Light to Ecological Problems.*

May 8: Mr. Robert W. Poole (Cornell University), *The Organization of a Muellerian Mimicry Complex in Northern Venezuela.*

May 15: Mr. Lee Miller (Harvard University), *Behavior of Flying Green Lacewings.*

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